

NOTE: Refer to the Supplement at the back of this manual for procedures unique to 2006-on models.

## CHAPTER ONE

# GENERAL INFORMATION

This detailed and comprehensive manual covers the Honda TRX250EX Sportrax and TRX250X from 2001-2012.

The text provides complete information on maintenance, tune-up, repair and overhaul. Hundreds of photographs and illustrations, created during the complete disassembly of the ATV, guide the reader through every job. All procedures are in step-by-step format and designed for the reader who may be working on the machine for the first time.

### MANUAL ORGANIZATION

A shop manual is a tool, and as in all Clymer manuals, the chapters are thumb-tabbed for easy reference. Main headings are listed in the table of contents and index. Frequently used specifications and capacities from the tables at the end of each chapter are listed in the *Quick Reference Data* section at the front of the manual. Specifications and capacities are provided in U.S. Standard and metric units of measure.

During some of the procedures there may be references to headings in other chapters or sections of the manual. When a specific heading is called out in

a step it is *italicized* as it appears in the manual. If a sub-heading is indicated as being “in this section,” it is located within the same main heading. For example, the sub-heading *Handling Gasoline Safely* is located within the main heading SAFETY.

This chapter provides general information on shop safety, tools and their usage, service fundamentals and shop supplies. General vehicle specifications are in **Tables 1-8** at the end of the chapter.

Chapter Two provides methods for quick and accurate diagnosis of problems. Troubleshooting procedures present typical symptoms and logical methods to pinpoint and repair the problem.

Chapter Three explains all routine maintenance necessary to keep the vehicle running well.

Subsequent chapters describe specific systems, such as engine, transmission, clutch, drive system, fuel system, suspension, brakes and body.

### WARNINGS, CAUTIONS AND NOTES

The terms WARNING, CAUTION and NOTE have specific meanings in this manual.

A WARNING emphasizes areas where injury or death could result from negligence. Mechanical

damage may also occur. **WARNINGS** are to be taken seriously.

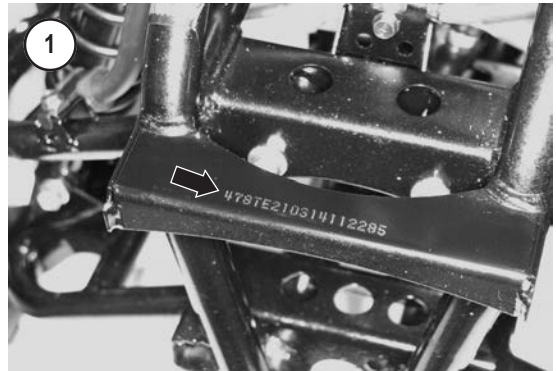
A **CAUTION** emphasizes areas where equipment damage could result. Disregarding a **CAUTION** could cause permanent mechanical damage, though injury is unlikely.

A **NOTE** provides additional information to make a step or procedure easier or clearer. Disregarding a **NOTE** could cause inconvenience, but would not cause equipment damage or injury.

## SAFETY

Professional mechanics can work for years and never sustain an injury or mishap. Follow these guidelines and practice common sense to safely service the vehicle.

1. Do not operate the vehicle in an enclosed area. The exhaust gasses contain carbon monoxide, an odorless, colorless and tasteless poisonous gas. Carbon monoxide levels build quickly in small enclosed areas and can cause unconsciousness and death in a short time. Make sure to properly ventilate the work area or operate the vehicle outside.
2. Never use gasoline or any extremely flammable liquid to clean parts. Refer to *Handling Gasoline Safely* and *Cleaning Parts* in this section.
3. Never smoke or use a torch in the vicinity of flammable liquids, such as gasoline or cleaning solvent.
4. If welding or brazing on the vehicle, remove the fuel tank to a safe distance at least 15 m (50 ft.) away.
5. Use the correct type and size of tools to avoid damaging fasteners.
6. Keep tools clean and in good condition. Replace or repair worn or damaged equipment.
7. When loosening a tight fastener, be guided by what would happen if the tool slips.
8. When replacing fasteners, make sure the new fasteners are the same size and strength as the originals.
9. Keep the work area clean and organized.
10. Wear eye protection *any time* the safety of the eyes is in question. This includes procedures that involve drilling, grinding, hammering, compressed air and chemicals.
11. Wear the correct clothing for the job. Tie up or cover long hair so it does not get caught in moving equipment.
12. Do not carry sharp tools in clothing pockets.



13. Always have an approved fire extinguisher available. Make sure it is rated for gasoline (Class B) and electrical (Class C) fires.

14. Do not use compressed air to clean clothes, the vehicle or work area. Debris may be blown into the eyes or skin. *Never* direct compressed air at anyone. Do not allow children to use or play with any compressed air equipment.

15. When using compressed air to dry rotating parts, hold the part so it does not rotate. Do not allow the force of the air to spin the part. The air jet is capable of rotating parts at extreme speed. The part may disintegrate or become damaged, causing injury.

16. Do not inhale the dust created by brake pad and clutch wear. These particles may contain asbestos. In addition, some types of insulating materials and gaskets may contain asbestos. Inhaling asbestos particles is hazardous to health.

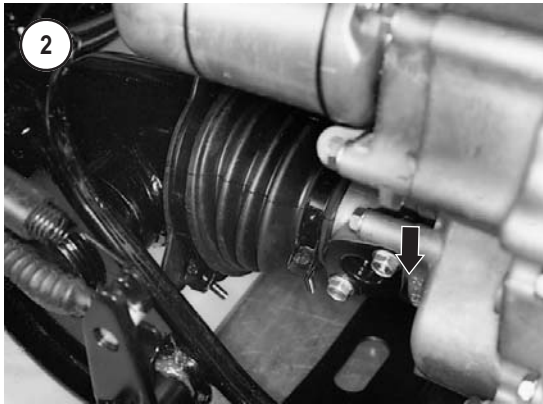
17. Never work on the vehicle while someone is working under it.

18. When placing the vehicle on a stand, make sure it is secure before walking away.

## Handling Gasoline Safely

Gasoline is a volatile, flammable liquid and is one of the most dangerous items in the shop. Because gasoline is used so often, many people forget it is hazardous. Only use gasoline as fuel for gasoline internal combustion engines. Keep in mind when working on the machine that gasoline is always present in the fuel tank and fuel lines. To avoid an accident when working around the fuel system, carefully observe the following:

1. Never use gasoline to clean parts. Refer to *Cleaning Parts* in this section.



2. When working on the fuel system, work outside or in a well-ventilated area.
3. Do not add fuel to the fuel tank or service the fuel system while the vehicle is near open flames, sparks or where someone is smoking. Gasoline vapor is heavier than air; it collects in low areas and is more easily ignited than liquid gasoline.
4. Allow the engine to cool completely before working on any fuel system component.
5. Do not store gasoline in glass containers. If the glass breaks, an explosion or fire may occur.
6. Immediately wipe up spilled gasoline with rags. Store the rags in a metal container with a lid until they can be properly disposed of, or place them outside in a safe place for the fuel to evaporate.
7. Do not pour water onto a gasoline fire. Water spreads the fire and makes it more difficult to put out. Use a class B, BC or ABC fire extinguisher to extinguish the fire.
8. Always turn off the engine before refueling. Do not spill fuel onto the engine or exhaust system. Do not overfill the fuel tank. Leave an air space at the top of the tank to allow room for the fuel to expand due to temperature fluctuations.

### Cleaning Parts

Cleaning parts is one of the more difficult service jobs performed in the home garage. Many types of chemical cleaners and solvents are available for shop use. Most are poisonous and extremely flammable. To prevent chemical exposure, vapor buildup, fire and injury, observe each product warning label and note the following:

1. Read and observe the entire product label before using any chemical. Always know what type of

chemical is being used and whether it is poisonous and/or flammable.

2. Do not use more than one type of cleaning solvent at a time. If mixing chemicals is required, measure the proper amounts according to the manufacturer.
3. Work in a well-ventilated area.
4. Wear chemical-resistant gloves.
5. Wear safety glasses.
6. If the instructions call for it, wear a vapor respirator.
7. Wash hands and arms thoroughly after cleaning parts.
8. Keep chemical products away from children and pets.
9. Thoroughly clean all oil, grease and cleaner residue from any part that must be heated.
10. Use a nylon brush when cleaning parts. Metal brushes may cause a spark.
11. When using a parts washer, only use the solvent recommended by the manufacturer. Make sure the parts washer is equipped with a metal lid that lowers in case of fire.

### Warning Labels

Most manufacturers attach information and warning labels to the vehicle. These labels contain instructions that are important to safety when operating, servicing, transporting and storing the vehicle. Refer to the owner's manual for the description and location of labels. Order replacement labels from the manufacturer if they are missing or damaged.

### VIN NUMBERS

Vehicle identification numbers are stamped on the frame and engine. Record these numbers in the *Quick Reference Data* section at the front of the book. Have these numbers available when ordering parts.

The frame number (**Figure 1**), or VIN number, is stamped on the front of the frame. The engine number (**Figure 2**) is stamped on the rear of the right side of the crankcase, just ahead of the drive shaft boot.

Refer to **Table 1** for VIN information.

## FASTENERS

Proper fastener selection and installation is important to ensure the vehicle operates as designed and can be serviced efficiently. The choice of original equipment fasteners is not arrived at by chance. Make sure replacement fasteners meet all the same requirements as the originals.

### Threaded Fasteners

Threaded fasteners secure most of the components on the vehicle. Most are tightened by turning them clockwise (right-hand threads). If the normal rotation of the component being tightened would loosen the fastener, it may have left-hand threads. If a left-hand threaded fastener is used, it is noted in the text.

Two dimensions are required to match the thread size of the fastener: the number of threads in a given distance and the outside diameter of the threads.

The two systems currently used to specify threaded fastener dimensions are the U.S. Standard system and the metric system (**Figure 3**). Pay particular attention when working with unidentified fasteners; mismatching thread types can damage threads.

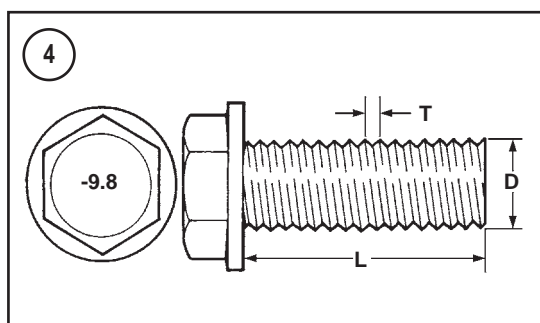
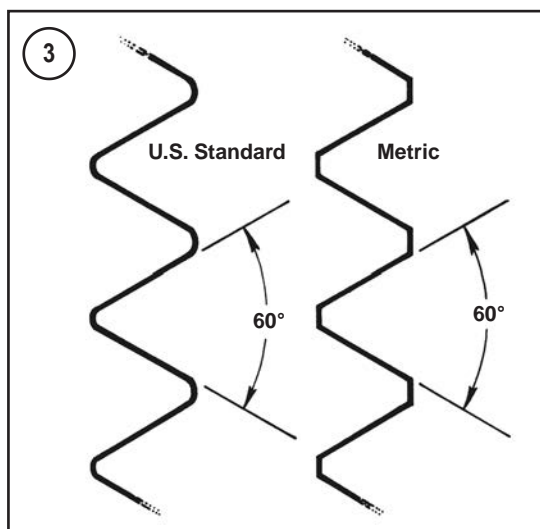
#### NOTE

*To ensure that the fastener threads are not mismatched or cross-threaded, start all fasteners by hand. If a fastener is difficult to start or turn, determine the cause before tightening with a wrench.*

The length (L, **Figure 4**), diameter (D) and distance between thread crests (pitch [T]) classify metric screws and bolts. A typical bolt may be identified by the numbers, 8 – 1.25 × 130. This indicates the bolt has a diameter of 8 mm, the distance between thread crests is 1.25 mm and the length is 130 mm. Always measure bolt length as shown in L, **Figure 4** to avoid purchasing replacements of the wrong length.

#### WARNING

*Do not install fasteners with a strength classification lower than what was originally installed by the manufacturer. Doing so may cause equipment failure and/or damage.*



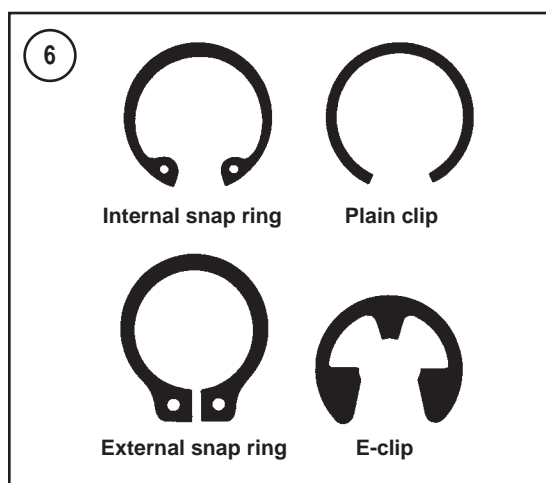
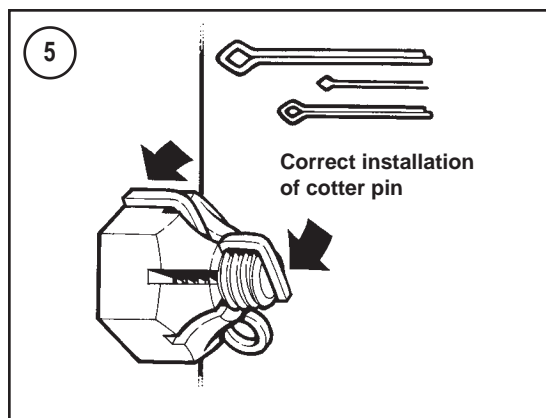
The numbers on the top of the fastener (**Figure 4**) indicate the strength of metric screws and bolts. The higher the number, the stronger the fastener. Typically, unnumbered fasteners are the weakest.

Many screws, bolts and studs are combined with nuts to secure particular components. To indicate the size of a nut, manufacturers specify the internal diameter and thread pitch.

The measurement across two flats on a nut or bolt indicates the wrench size.

### Torque Specifications

The materials used in the manufacturing of the vehicle may be subjected to uneven stresses if the fasteners of the subassemblies are not installed and tightened correctly. Improperly installed fasteners or ones that became loose can cause extensive damage. It is essential to use an accurate torque wrench as described in this chapter.



Specifications for torque are provided in Newton-meters (N•m), foot-pounds (ft.-lb.) and inch-pounds (in.-lb.). Refer to **Table 8** for general torque specifications. To determine the torque requirement, first determine the size of the fastener as described in *Threaded Fasteners* in this section. Torque specifications for specific components are at the end of the appropriate chapters. Torque wrenches are covered in *Basic Tools* in this chapter.

### Self-Locking Fasteners

Several types of bolts, screws and nuts incorporate a system that creates interference between the two fasteners. Interference is achieved in various ways, such as the nylon insert nut, or a dry adhesive coating, on the threads of a bolt.

Self-locking fasteners offer greater holding strength than standard fasteners, which improves

their resistance to vibration. The materials used to form the lock become distorted after the initial installation and removal. Do not reuse or replace self-locking fasteners with standard fasteners.

### Washers

The two basic types of washers are flat washers and lockwashers. Flat washers are simple discs with a hole to fit a screw or bolt. Lockwashers are used to prevent a fastener from working loose. Washers can be used as spacers and seals or can help distribute fastener load and prevent the fastener from damaging the component.

As with fasteners, when replacing washers, make sure the replacement washers are of the same design and quality.

### Cotter Pins

A cotter pin is a split metal pin inserted into a hole or slot to prevent a fastener from loosening. In certain applications, such as the rear axle nut on an ATV, the fastener must be secured in this way. For these applications, a cotter pin and castellated (slotted) nut is used.

To use a cotter pin, make sure the diameter is correct for the hole in the fastener. After correctly tightening the fastener and aligning the holes, insert the cotter pin through the hole and bend the ends over the fastener (**Figure 5**). Unless instructed to do so, never loosen a tightened fastener to align the holes. If the holes do not align, tighten the fastener enough to achieve alignment.

Cotter pins are available in various diameters and lengths. Measure the length from the bottom of the head to the tip of the shortest pin.

### Snap Rings and E-clips

Snap rings (**Figure 6**) are circular-shaped metal retaining clips. They are required to secure parts and gears in place on items, such as shafts, pins or rods. External-type snap rings are used to retain items on shafts. Internal-type snap rings secure parts within housing bores. In some applications, in addition to securing the component(s), snap rings of varying thickness also determine endplay. These are usually called selective snap rings.

The two basic types of snap rings are machined and stamped snap rings. Machined snap rings (**Figure 7**) can be installed in either direction because both faces have sharp edges. Stamped snap rings (**Figure 8**) are manufactured with a sharp and a rounded edge. When installing a stamped snap ring in a thrust application, install the sharp edge facing away from the part producing the thrust.

E-clips are used when it is not practical to use a snap ring. Remove E-clips with a flat blade screwdriver by prying between the shaft and E-clip. To install an E-clip, center it over the shaft groove and push or tap it into place.

Observe the following when installing snap rings:

1. Remove and install snap rings with snap ring pliers. Refer to *Basic Tools* in this chapter.
2. In some applications, it may be necessary to replace snap rings after removing them.
3. Compress or expand snap rings only enough to install them. If overly expanded, they lose their retaining ability.
4. After installing a snap ring, make sure it seats completely.
5. Wear eye protection when removing and installing snap rings.

## SHOP SUPPLIES

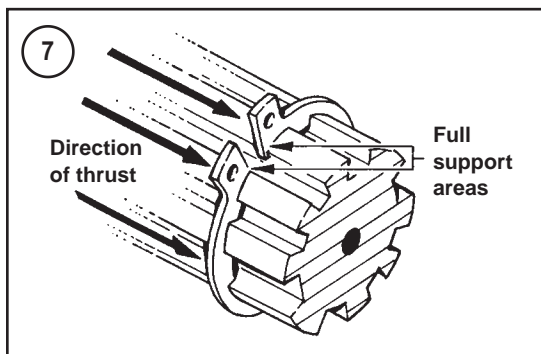
### Lubricants and Fluids

Periodic lubrication helps ensure a long service life for any type of equipment. Using the correct type of lubricant is as important as performing the lubrication service, although in an emergency the wrong type is better than not using one. The following section describes the types of lubricants most often required. Make sure to follow the manufacturer's recommendations for lubricant types.

#### Engine oils

Engine oil for four-stroke ATV engine use is classified by three standards: the American Petroleum Institute (API) service classification, the Society of Automotive Engineers (SAE) viscosity rating and the Japanese Automobile Standards Organization (JASO) T 903 Standard rating.

The API and SAE information is on all oil container labels. The JASO information is found on oil containers sold by the oil manufacturer specifically



for ATV and motorcycle use. Two letters indicate the API service classification. The number or sequence of numbers and letter (10W-40 for example) is the oil's viscosity rating. The API service classification and the SAE viscosity index are not indications of oil quality.

The API service classification indicates that the oil meets specific lubrication standards. The first letter in the classification S indicates the oil is for gasoline engines. The second letter indicates the standard the oil satisfies.

The JASO certification label identifies two separate oil classifications and a registration number to ensure the oil has passed all JASO certification standards for use in four-stroke ATV and motorcycle engines. The classifications are: MA (high-friction applications) and MB (low-friction applications). Only oil that has passed JASO standards can carry the JASO certification label.

#### NOTE

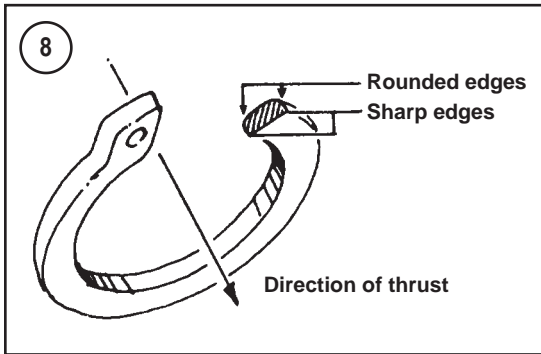
Refer to **Engine Oil and Filter** in Chapter Three for more information on API, SAE and JASO ratings.

Always use oil with a classification recommended by the manufacturer. Using oil with a different classification can cause engine damage.

Viscosity is an indication of the oil's thickness. Thin oils have a lower number and thick oils have a higher number. Engine oils fall into the 5- to 50-weight range for single-grade oils.

Most manufacturers recommend multi-grade oil. These oils perform efficiently across a wide range of operating conditions. Multi-grade oils are identified by a W after the first number, which indicates the low-temperature viscosity.

Engine oils are most commonly mineral (petroleum) based, but synthetic and semi-synthetic types



are used more frequently. When selecting engine oil, follow the manufacturer's recommendation for type, classification and viscosity.

### Greases

Grease is lubricating oil with added thickening agents. The National Lubricating Grease Institute (NLGI) grades grease. Grades range from No. 000 to No. 6, with No. 6 being the thickest. Typical multipurpose grease is NLGI No. 2. For specific applications, manufacturers may recommend water-resistant type grease or one with an additive, such as molybdenum disulfide ( $\text{MoS}_2$ ).

### Brake fluid

Brake fluid is the hydraulic fluid used to transmit hydraulic pressure (force) to the wheel brakes. It is classified by the Department of Transportation (DOT). Current designations for brake fluid are DOT 3, DOT 4 and DOT 5. This classification appears on the fluid container.

Each type of brake fluid has its own definite characteristics. Do not intermix different types because this may cause brake system failure. DOT 5 brake fluid is silicone based and is not compatible with other brake fluids or in systems for which it was not designed. Mixing DOT 5 fluid with other fluids may cause brake system failure. When adding brake fluid, *only* use the fluid recommended by the manufacturer.

Brake fluid damages any plastic, painted or plated surface it contacts. Use extreme care when working with brake fluid and remove any spills immediately with soap and water.

Hydraulic brake systems require clean and moisture-free brake fluid. Never reuse brake fluid. Keep containers and reservoirs properly sealed.

### WARNING

*Never put a mineral-based (petroleum) oil into the brake system. Mineral oil causes rubber parts in the system to swell and break apart, causing complete brake failure.*

### Coolant

Coolant is a mixture of water and antifreeze used to dissipate engine heat. Ethylene glycol is the most common form of antifreeze. Check the manufacturer's recommendations when selecting antifreeze. Most require one specifically designed for use in aluminum engines. These types of antifreeze have additives that inhibit corrosion. Only mix antifreeze with distilled water. Impurities in tap water may damage internal cooling system passages.

### Cleaners, Degreasers and Solvents

Many chemicals are available to remove oil, grease and other residue from the vehicle. Before using cleaning solvents, consider how they are used and disposed of, particularly if they are not water-soluble. Local ordinances may require special procedures for the disposal of many types of cleaning chemicals. Refer to *Safety* in this chapter.

Use brake parts cleaner to clean brake system components because it leaves no residue. Use electrical contact cleaner to clean electrical connections and components without leaving any residue. Carburetor cleaner is a powerful solvent used to remove fuel deposits and varnish from fuel system components. Use this cleaner carefully because it may damage finishes.

Generally, degreasers are strong cleaners used to remove heavy accumulations of grease from engine and frame components.

Most solvents are designed to be used with a parts washing cabinet for individual component cleaning. For safety, use only nonflammable or high flash point solvents.

### Gasket Sealant

Gasket sealant is used in combination with a gasket or seal. In other applications, such as between crankcase halves, only a sealant is used. Follow the manufacturer's recommendation when using a seal-

ant. Use extreme care when choosing a sealant different from the type originally recommended. Choose sealant based on its resistance to heat, various fluids and sealing capabilities.

A common sealant is room temperature vulcanization sealant, or RTV. This sealant cures at room temperature over a specific time period. This allows the repositioning of components without damaging gaskets.

Moisture in the air causes the RTV sealant to cure. Always install the tube cap as soon as possible after applying RTV sealant. RTV sealant has a limited shelf life and does not cure properly if the shelf life has expired. Keep partial tubes sealed and discard them if they have surpassed the expiration date.

### Applying RTV sealant

Clean all old gasket residue from the mating surfaces. Remove all gasket material from blind threaded holes to avoid inaccurate bolt torque. Spray the mating surfaces with aerosol parts cleaner, and wipe with a lint-free cloth. The area must be clean for the sealant to adhere.

Apply RTV sealant in a continuous bead 2-3 mm (0.08-0.12 in.) thick. Circle all the fastener holes unless otherwise specified. Do not allow any sealant to enter these holes. Assemble and tighten the fasteners to the specified torque within the time frame recommended by the sealant manufacturer.

### Gasket Remover

Aerosol gasket remover can help remove stubborn gaskets. This product can speed up the removal process and prevent damage to the mating surface that may be caused by using a scraping tool. Most of these types of products are very caustic. Follow the gasket remover manufacturer's instructions for use.

### Threadlocking Compound

A threadlocking compound is a fluid applied to the threads of fasteners. After tightening the fastener, the fluid dries and becomes a solid filler between the threads. This makes it difficult for the fastener to work loose from vibration or heat expansion and contraction. Some threadlocking compounds also provide a seal against fluid leaks.



Before applying a threadlocking compound, remove any old compound from both thread areas and clean them with aerosol parts cleaner. Use the compound sparingly. Excess fluid can run into adjoining parts.

#### CAUTION

*Threadlocking compounds are anaerobic and stress, crack and attack most plastics. Use caution when using these products in areas where there are plastic components.*

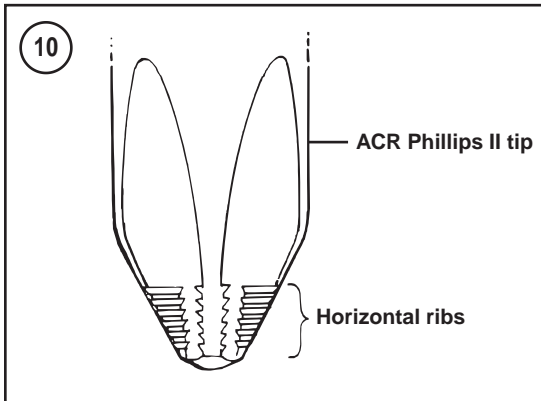
Threadlocking compounds are available in a wide range of compounds for various strength, temperature and repair applications. Follow the manufacturer's recommendations regarding compound selection.

### TOOLS

Most of the procedures in this manual can be carried out with simple hand tools and test equipment familiar to the home mechanic. Always use the correct tools for the job at hand. Keep tools organized and clean. Store them in a tool chest with related tools organized together.

Quality tools are essential. The best are constructed of high-strength alloy steel. These tools are light, easy-to-use and resistant to wear. Their working surface is devoid of sharp edges and carefully polished. They have an easy-to-clean finish and are comfortable to use. Quality tools are a good investment.

Some of the procedures in this manual specify special tools. In many cases the tool is illustrated in use. In some cases it may be possible to use a suitable substitute or fabricate a suitable replacement. However, the specialized equipment or expertise may make it impractical for the home mechanic to do the procedure. When necessary, such operations



come with the recommendation to have a dealership or specialist perform the task. It may be less expensive to have a professional perform these jobs, especially when considering the cost of equipment.

The manufacturer's part number is provided for many of the tools mentioned in this manual. These part numbers are correct at the time of the first edition publication. The publisher cannot guarantee the part numbers or tools listed in this manual will be available in the future.

When purchasing tools to perform the procedures covered in this manual, consider the tool's potential frequency of use. If a tool kit is just now being started, consider purchasing a basic tool set (**Figure 9**). These sets are available in many tool combinations and offer substantial savings when compared to individually purchased tools. As work experience grows and tasks become more complicated, specialized tools can be added.

## Screwdrivers

Screwdrivers of various lengths and types are mandatory for the simplest tool kit. The two basic

types are the slotted tip (flat blade) and the Phillips tip. These are available in sets that often include an assortment of tip sizes and shaft lengths.

As with all tools, use a screwdriver designed for the job. Make sure the size of the tip conforms to the size and shape of the fastener. Use them only for driving screws. Never use a screwdriver for prying or chiseling metal. Repair or replace worn or damaged screwdrivers. A worn tip may damage the fastener, making it difficult to remove.

### NOTE

*Another way to prevent camout and to increase the grip of a Phillips screwdriver is to apply valve grinding compound or Permatex Screw & Socket Gripper onto the screwdriver tip. After loosening/tightening the screw, clean the screw recess to prevent engine oil contamination.*

Phillips-head screws are often damaged by incorrectly fitting screwdrivers. Quality Phillips screwdrivers are manufactured with their crosshead tip machined to Phillips Screw Company specifications. Poor quality or damaged Phillips screwdrivers can back out (camout) and round over the screw head. In addition, weak or soft screw materials can make removal difficult.

The best type of screwdriver to use on Phillips screws is the ACR Phillips II screwdriver, patented by the Phillips Screw Company. ACR stands for the horizontal anti-camout ribs found on the driving faces or flutes of the screwdriver's tip (**Figure 10**). ACR Phillips II screwdrivers were designed as part of a manufacturing drive system to be used with ACR Phillips II screws, but they work well on all common Phillips screws. A number of tool companies offer ACR Phillips II screwdrivers in different tip sizes and interchangeable bits to fit screwdriver bit holders.

## Wrenches

Open-end, box-end and combination wrenches (**Figure 11**) are available in a variety of types and sizes.

The number stamped on the wrench refers to the distance between the work areas. This size must match the size of the fastener head.

The box-end wrench grips the fastener on all sides, reducing the chance of the tool slipping. The box-end wrench is designed with either a 6- or 12-point opening. For stubborn or damaged fasteners, the 6-point provides superior holding because it contacts the fastener across a wider area at all six edges. For general use, the 12-point works well. It allows the wrench to be removed and reinstalled without moving the handle over such a wide arc.

An open-end wrench is fast and works best in areas with limited overhead access. It contacts the fastener at only two points and is subject to slipping if under heavy force or if the tool or fastener is worn. A box-end wrench is preferred in most instances, especially when breaking loose and applying the final tightness to a fastener.

The combination wrench has a box-end on one end and an open-end on the other. This combination makes it a convenient tool.

### Adjustable Wrenches

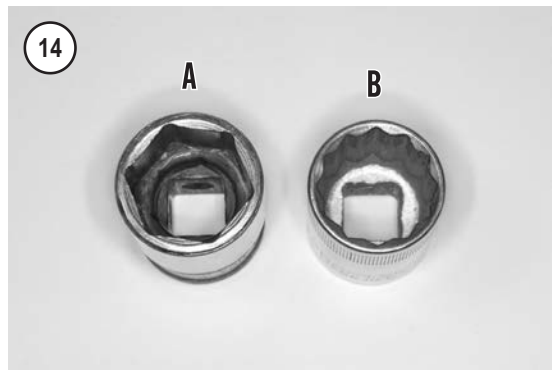
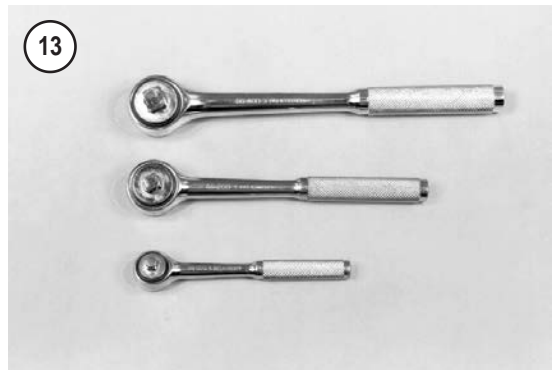
An adjustable wrench, or Crescent wrench (**Figure 12**), can fit nearly any nut or bolt head that has clear access around its entire perimeter. An adjustable wrench is best used as a backup wrench to keep a large nut or bolt from turning while the other end is being loosened or tightened with a box-end or socket wrench.

Adjustable wrenches contact the fastener at only two points, which makes them more subject to slipping off the fastener. Because one jaw is adjustable and may become loose, this shortcoming is aggravated. Make sure the solid jaw is the one transmitting the force.

### Socket Wrenches, Ratchets and Handles

Sockets that attach to a ratchet handle (**Figure 13**) are available with 6-point (A, **Figure 14**) or 12-point (B, **Figure 14**) openings and different drive sizes. The drive size indicates the size of the square hole that accepts the ratchet handle. The number stamped on the socket is the size of the work area and must match the fastener head.

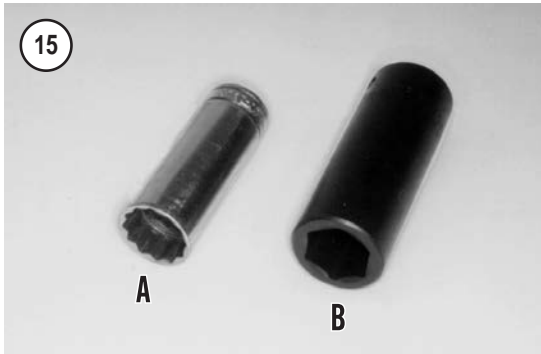
As with wrenches, a 6-point socket provides superior-holding ability, while a 12-point socket needs to be moved only half as far to reposition it on the fastener.



#### WARNING

*Do not use hand sockets with air or impact tools because they may shatter and cause injury. Always wear eye protection when using impact or air tools.*

Sockets are designated for either hand or impact use. Impact sockets are made of thicker material for more durability. Compare the size and wall thickness of a 19-mm hand socket (A, **Figure 15**) and the 19-mm impact socket (B). Use impact sockets when



using an impact driver or air tools. Use hand sockets with hand-driven attachments.

Various handles are available for sockets. Use the speed handle for fast operation. Flexible ratchet heads in varying lengths allow the socket to be turned with varying force and at odd angles. Extension bars allow the socket setup to reach difficult areas. The ratchet is the most versatile. It allows the user to install or remove the nut without removing the socket.

Sockets combined with any number of drivers make them undoubtedly the fastest, safest and most convenient tool for fastener removal and installation.

## Impact Drivers

### WARNING

*Do not use hand sockets with air or impact tools because they may shatter and cause injury. Always wear eye protection when using impact or air tools.*

An impact driver provides extra force for removing fasteners by converting the impact of a hammer into a turning motion. This makes it possible to remove stubborn fasteners without damaging them. Impact drivers and interchangeable bits (**Figure 16**) are available from most tool suppliers. When using a socket with an impact driver, make sure the socket is designed for impact use. Refer to *Socket Wrenches, Ratchets and Handles* in this section.

## Allen Wrenches

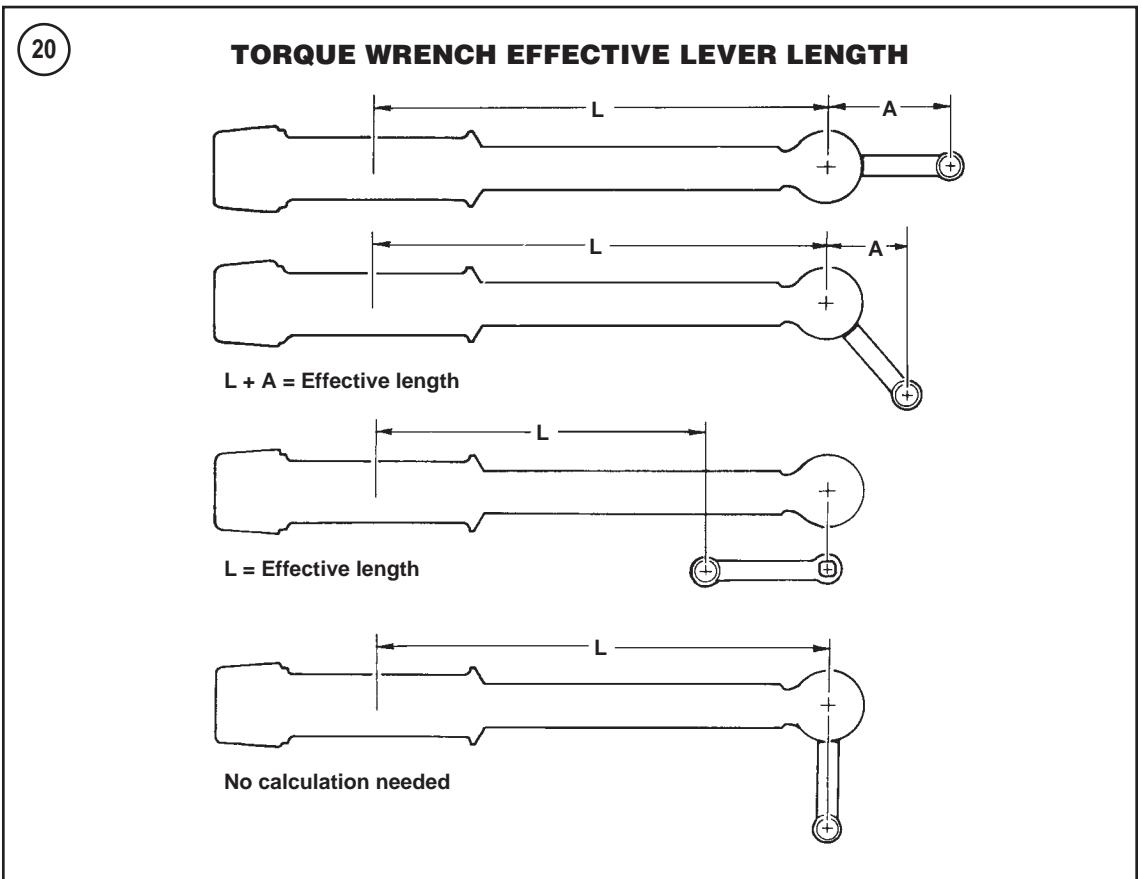
Use Allen, or setscrew wrenches, (**Figure 17**) on fasteners with hexagonal recesses in the fastener head. These wrenches are available in L-shaped bar, socket and T-handle types. A metric set is required when working on most ATVs. Allen bolts are sometimes called socket bolts.

## Torque Wrenches

Use a torque wrench with a socket, torque adapter or similar extension to tighten a fastener to a measured torque. Torque wrenches come in several drive sizes (1/4, 3/8, 1/2 and 3/4) and have various methods of reading the torque value. The drive size indicates the size of the square drive that accepts the socket, adapter or extension. Common methods of reading the torque value are the deflecting beam, the dial indicator and the audible click (**Figure 18**).

When choosing a torque wrench, consider the torque range, drive size and accuracy. The torque specifications in this manual provide an indication of the range required.

A torque wrench is a precision tool that must be properly cared for to remain accurate. Store torque wrenches in cases or separate padded drawers within a toolbox. Follow the manufacturer's instructions for their care and calibration.



### Torque Adapters

Torque adapters or extensions extend or reduce the reach of a torque wrench. The torque adapter shown in **Figure 19** is used to tighten a fastener that cannot be reached because of the size of the torque wrench head, drive and socket. If a torque adapter changes the effective lever length (**Figure 20**), the torque reading on the wrench will not equal the ac-

tual torque applied to the fastener. It is necessary to recalibrate the torque setting on the wrench to compensate for the change of lever length. When using a torque adapter at a right angle to the drive head, calibration is not required because the effective length has not changed.

To recalculate a torque reading when using a torque adapter, use the following formula and refer to **Figure 20**:



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22



23

$$TW = \frac{TA \times L}{L + A}$$

$TW$  is the torque setting or dial reading on the wrench.

$TA$  is the torque specification and the actual amount of torque that is applied to the fastener.

$A$  is the amount the adapter increases (or in some cases reduces) the effective lever length as measured along the centerline of the torque wrench.

$L$  is the lever length of the wrench as measured from the center of the drive to the center of the grip.

The effective length is the sum of  $L$  and  $A$ .

Example:

$TA = 20 \text{ ft.-lb.}$

$A = 3 \text{ in.}$

$L = 14 \text{ in.}$

$TW = \frac{20 \times 14}{14 + 3} = \frac{280}{17} = 16.5 \text{ ft.-lb.}$

$14 + 3 = 17$

In this example, the torque wrench would be set to the recalculated torque value ( $TW = 16.5 \text{ ft.-lb.}$ ). When using a beam-type wrench, tighten the fastener until the pointer aligns with  $16.5 \text{ ft.-lb.}$  In this example, although the torque wrench is preset to  $16.5 \text{ ft.-lb.}$ , the actual torque is  $20 \text{ ft.-lb.}$

## Pliers

Pliers come in a wide range of types and sizes. Pliers are used for holding, cutting, bending and crimping. Do not use them to turn fasteners. **Figure 21** and **Figure 22** show several types of useful pliers. Each design has a specialized function. Slip-joint pliers are general-purpose pliers used for gripping and bending. Diagonal-cutting pliers are needed to cut wire and can be used to remove cotter pins. Use needlenose pliers to hold or bend small objects. Locking pliers (**Figure 23**), sometimes called Vise-Grips, are used to hold objects very tightly. They have many uses, ranging from holding two parts together, to gripping the end of a broken stud. Use caution when using locking pliers, as the sharp jaws damage the objects they hold.

## Snap Ring Pliers

### WARNING

*Snap rings can slip and fly off when removing and installing. Also, the snap ring pliers' tips may break. Always wear eye protection when using snap ring pliers.*

Snap ring pliers are specialized pliers with tips that fit into the ends of snap rings to remove and install them. Snap ring pliers (**Figure 24**) are available with a fixed action (either internal or external) or convertible (one tool works on both internal and external snap rings). They may have fixed tips or interchangeable ones of various sizes and angles. For general use, select convertible-type pliers with interchangeable tips.

## Hammers

Different types of hammers (**Figure 25**) are available to fit a number of applications. Use a ball-peen hammer to strike another tool, such as a punch or chisel. Use soft-faced hammers when a metal object must be struck without damaging it. Never use a metal-faced hammer on engine and suspension components because damage occurs in most cases.

Always wear eye protection when using hammers. Make sure the hammer face is in good condition and the handle is not cracked. Select the correct hammer for the job and make sure to strike the object squarely. Do not use the handle or the side of the hammer to strike an object.

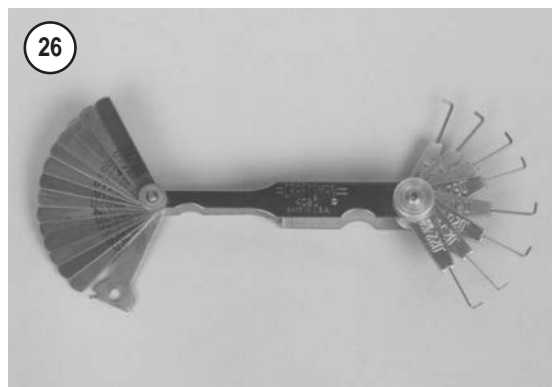
## PRECISION MEASURING TOOLS

The ability to accurately measure components is essential to perform many of the procedures described in this manual. Equipment is manufactured to close tolerances, and obtaining consistently accurate measurements is essential to determine which components require replacement or further service.

Each type of measuring instrument is designed to measure a dimension with a certain degree of accuracy and within a certain range. When selecting the measuring tool, make sure it is applicable to the task.

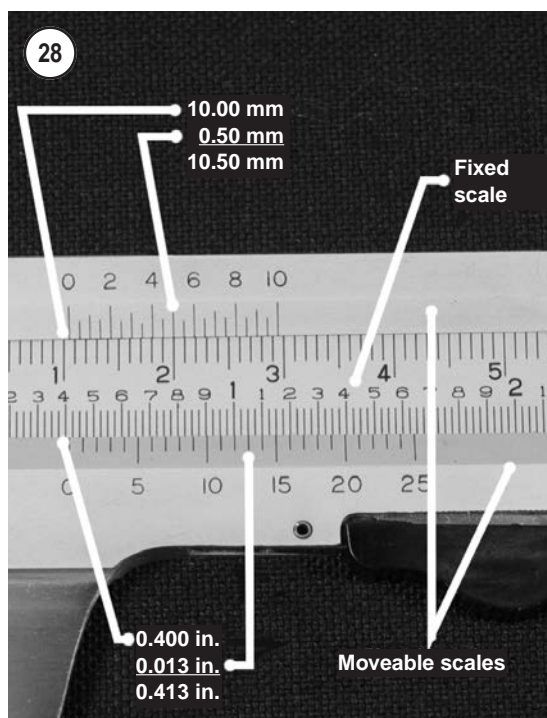
As with all tools, measuring tools provide the best results if cared for properly. Improper use can damage the tool and cause inaccurate results. If any measurement is questionable, verify the measurement using another tool. A standard gauge is usually provided with micrometers to check accuracy and calibrate the tool if necessary.

Precision measurements can vary according to the experience of the person performing the procedure. Accurate results are only possible if the mechanic possesses a feel for using the tool. Heavy-handed use of measuring tools produces less accurate results. Hold the tool gently by the fingertips to easily feel the point at which the tool contacts the object. This feel for the equipment produces more accurate measurements and reduces the risk of damaging the tool or component. Refer to the following sections for specific measuring tools.



## Feeler Gauge

Use feeler or thickness gauges (**Figure 26**) for measuring the distance between two surfaces. A feeler gauge set consists of an assortment of steel strips of graduated thicknesses. Each blade is marked with its thickness. Blades can be of various lengths and angles for different procedures. A common use for a feeler gauge is to measure valve clearance. Use wire (round) type gauges to measure spark plug gap.



## Calipers

Calipers (**Figure 27**) are used to obtain inside, outside and depth measurements. Although not as precise as a micrometer, they allow reasonable precision, typically to within 0.05 mm (0.001 in.). Most calipers have a range up to 150 mm (6 in.). Calipers are available in dial, vernier or digital versions. Dial calipers have a dial readout that provides convenient reading. Vernier calipers have marked scales that must be compared to determine the measurement. The digital caliper uses a liquid-crystal display (LCD) to show the measurement.

Properly maintain the measuring surfaces of the caliper. There must not be any dirt or burrs between

the tool and the object being measured. Never force the caliper to close around an object. Close the caliper around the highest point so it can be removed with a slight drag. Some calipers require calibration. Always refer to the manufacturer's instructions when using a new or unfamiliar caliper.

To learn how to read a vernier caliper, refer to **Figure 28**. The fixed scale is marked in 1-mm increments. Ten individual lines on the fixed scale equal 1 cm. The movable scale is marked in 0.05 mm (hundredth) increments. To obtain a reading, establish the first number by the location of the 0 line on the movable scale in relation to the first line to the left on the fixed scale. In this example, the number is 10 mm. To determine the next number, note which of the lines on the movable scale align with a mark on the fixed scale. A number of lines seem close, but only one aligns exactly. In this case, 0.50 mm is the reading to add to the first number. Adding 10 mm and 0.50 mm equals a measurement of 10.50 mm.

## Micrometers

A micrometer is an instrument designed for linear measurement using the decimal divisions of the inch or meter (**Figure 29**). While there are many types and styles of micrometers, most of the procedures in this manual call for an outside micrometer. Use the outside micrometer to measure the outside diameter of cylindrical forms and the thickness of materials.

A micrometer's size indicates the minimum and maximum size of a part it can measure. The usual sizes (**Figure 30**) are 0-25 mm (0-1 in.), 25-50 mm (1-2 in.), 50-75 mm (2-3 in.) and 75-100 mm (3-4 in.).

Micrometers that cover a wider range of measurements are available. These use a large frame with interchangeable anvils of various lengths. This type of micrometer offers a cost savings, but its overall size may make it less convenient. Refer to **Figure 31** for micrometer part identification.

## Adjustment

Before using a micrometer, check its adjustment as follows:

1. Clean the anvil and spindle faces.
- 2A. To check a 0-25 mm or 0-1 in. micrometer:

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**DECIMAL PLACE VALUES\***

<b>0.1</b>	Indicates 1/10 (one tenth of an inch or millimeter)
<b>0.010</b>	Indicates 1/100 (one one-hundredth of an inch or millimeter)
<b>0.001</b>	Indicates 1/1000 (one one-thousandth of an inch or millimeter)

**\*This chart represents the values of figures placed to the right of the decimal point. Use it when reading decimals from one-tenth to one one-thousandth of an inch or millimeter. It is not a conversion chart (for example: 0.001 in. is not equal to 0.001 mm).**

- a. Turn the thimble until the spindle contacts the anvil. If the micrometer has a ratchet stop, use it to ensure the proper amount of pressure is applied.
  - b. If the adjustment is correct, the 0 mark on the thimble aligns exactly with the 0 mark on the sleeve line. If the marks do not align, the micrometer is out of adjustment.
  - c. Follow the manufacturer's instructions to adjust the micrometer.
- 2B. To check a micrometer larger than 25 mm or 1 in. use the standard gauge supplied by the manufacturer. A standard gauge is a steel block, disc or rod that is machined to an exact size.
- a. Place the standard gauge between the spindle and anvil, and measure its outside diameter or length. If the micrometer has a ratchet stop, use it to ensure the proper amount of pressure is applied.
  - b. If the adjustment is correct, the 0 mark on the thimble aligns exactly with the 0 mark on the sleeve line. If the marks do not align, the micrometer is out of adjustment.
  - c. Follow the manufacturer's instructions to adjust the micrometer.

**Care**

Micrometers are precision instruments. They must be used and maintained with great care. Note the following:

1. Store micrometers in protective cases or separate padded drawers in a toolbox.
2. When in storage, make sure the spindle and anvil faces do not contact each other or another object. If



they do, temperature changes and corrosion may damage the contact faces.

3. Do not clean a micrometer with compressed air. Dirt forced into the tool causes wear.
4. Lubricate micrometers with WD-40 to prevent corrosion.

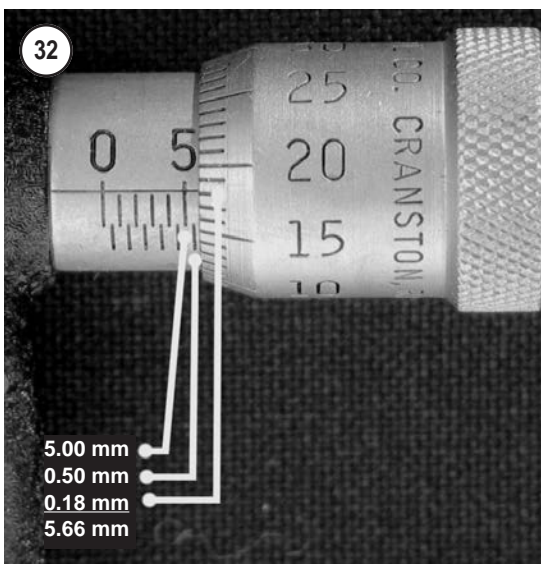
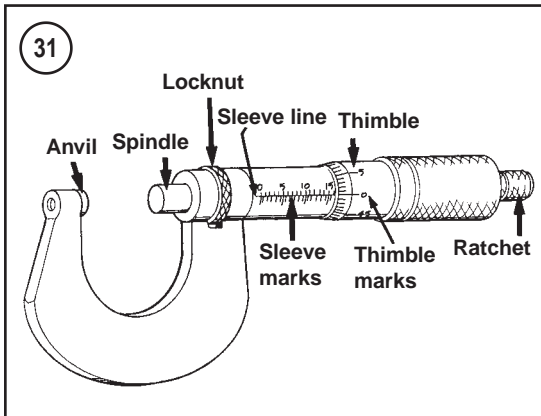
**Reading Micrometers**

When reading a micrometer, numbers are taken from different scales and added together. The following sections describe how to read the measurements of various types of outside micrometers.

For accurate results, properly maintain the measuring surfaces of the micrometer. There cannot be any dirt or burrs between the tool and the measured object. Never force the micrometer to close around an object. Close the micrometer around the highest point so it can be removed with a slight drag.

**Metric micrometer**

The standard metric micrometer is accurate to one one-hundredth of a millimeter (0.01 mm). The sleeve



line is graduated in millimeter and half millimeter increments. The marks on the upper half of the sleeve line equal 1.00 mm. Each fifth mark above the sleeve line is identified with a number. The number sequence depends on the size of the micrometer. A 0-25 mm micrometer, for example, has sleeve marks numbered 0 through 25 in 5 mm increments. This numbering sequence continues with larger micrometers. On all metric micrometers, each mark on the lower half of the sleeve equals 0.50 mm.

The tapered end of the thimble has 50 lines marked around it. Each mark equals 0.01 mm. One complete turn of the thimble aligns its 0 mark with the first line on the lower half of the sleeve line or 0.50 mm.

When reading a metric micrometer, add the number of millimeters and half-millimeters on the

sleeve line to the number of one one-hundredth millimeters on the thimble. Perform the following steps while referring to **Figure 32**:

1. Read the upper half of the sleeve line and count the number of lines visible. Each upper line equals 1 mm.
2. Check if the half-millimeter line is visible on the lower sleeve line. If so, add 0.50 mm to the reading in Step 1.

#### NOTE

*If a thimble mark does not align exactly with the sleeve line, estimate the amount between the lines. For accurate readings in two-thousandths of a millimeter (0.002 mm), use a metric vernier micrometer.*

3. Read the thimble mark that aligns with the sleeve line. Each thimble mark equals 0.01 mm.
4. Add the readings from Steps 1-3.

#### Standard inch micrometer

The standard inch micrometer is accurate to one-thousandth of an inch or 0.001. The sleeve is marked in 0.025 in. increments. Every fourth sleeve mark is numbered 1, 2, 3, 4, 5, 6, 7, 8 and 9. These numbers indicate 0.100, 0.200, 0.300 and so on.

The tapered end of the thimble has 25 lines marked around it. Each mark equals 0.001 in. One complete turn of the thimble aligns its zero mark with the first mark on the sleeve, or 0.025 in.

To read a standard inch micrometer, perform the following steps and refer to **Figure 33**.

1. Read the sleeve and find the largest number visible. Each sleeve number equals 0.100 in.
2. Count the number of lines between the numbered sleeve mark and the edge of the thimble. Each sleeve mark equals 0.025 in.

#### NOTE

*If a thimble mark does not align exactly with the sleeve line, estimate the amount between the lines. For accurate readings in ten-thousandths of an inch (0.0001 in.), use a vernier inch micrometer.*

3. Read the thimble mark that aligns with the sleeve line. Each thimble mark equals 0.001 in.
4. Add the readings from Steps 1-3.

## Telescoping and Small Bore Gauges

Use telescoping gauges (**Figure 34**) and small bore gauges (**Figure 35**) to measure bores. Neither gauge has a scale for direct readings. Use an outside micrometer to determine the reading.

To use a telescoping gauge, select the correct size gauge for the bore. Compress the movable post and carefully insert the gauge into the bore. Carefully move the gauge in the bore to make sure it is centered. Tighten the knurled end of the gauge to hold the movable post in position. Remove the gauge and measure the length of the posts. Telescoping gauges are typically used to measure cylinder bores.

To use a small bore gauge, select the correct size gauge for the bore. Carefully insert the gauge into the bore. Tighten the knurled end of the gauge to carefully expand the gauge fingers to the limit within the bore. Do not overtighten the gauge because there is no built-in release. Excessive tightening can damage the bore surface and damage the tool. Remove the gauge and measure the outside dimension (**Figure 36**). Small bore gauges are typically used to measure valve guides.

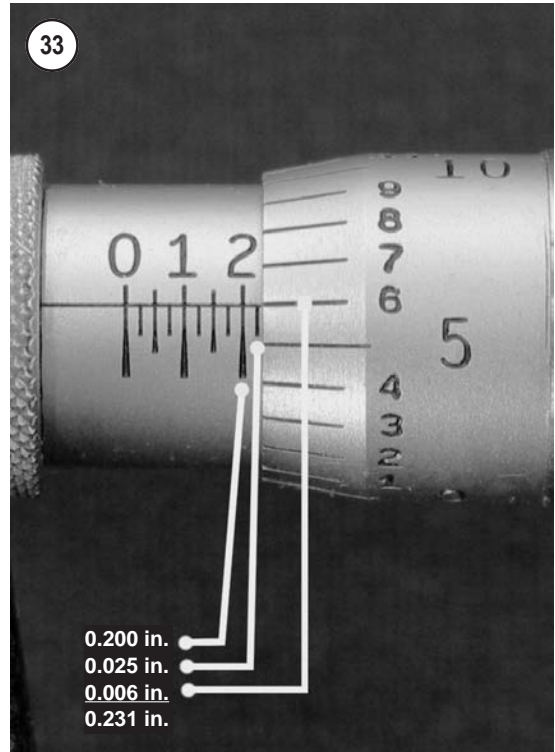
## Dial Indicator

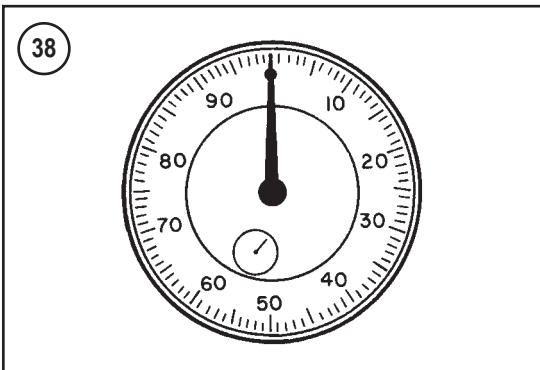
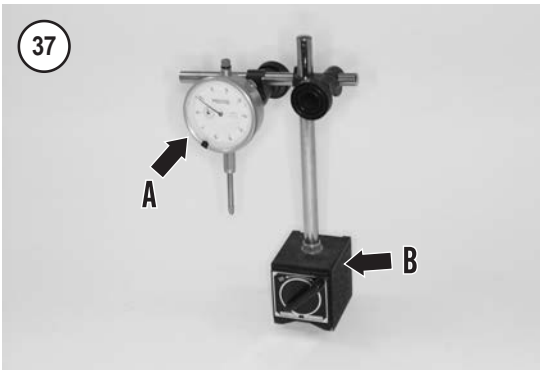
A dial indicator (A, **Figure 37**) is a gauge with a dial face and needle used to measure variations in dimensions and movements. Measuring brake rotor runout is a typical use for a dial indicator.

Dial indicators are available in various ranges and graduations and with three basic types of mounting bases: magnetic (B, **Figure 37**), clamp, or screw-in stud. When purchasing a dial indicator, select one with a continuous dial (**Figure 38**).

## Cylinder Bore Gauge

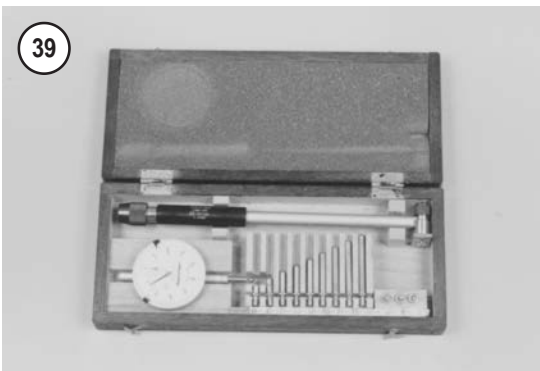
A cylinder bore gauge is similar to a dial indicator. The gauge set shown in **Figure 39** consists of a dial indicator, handle and different length adapters (anvils) to fit the gauge to various bore sizes. The bore gauge is used to measure bore size, taper and out-of-round. When using a bore gauge, follow the manufacturer's instructions.





### Compression Gauge

A compression gauge (**Figure 40**) measures combustion chamber (cylinder) pressure, usually in psi or kg/cm<sup>2</sup>. The gauge adapter is either inserted or screwed into the spark plug hole to obtain the reading. Disable the engine so it does not start and hold the throttle in the wide-open position when performing a compression test. An engine that does not have adequate compression cannot be properly tuned. Refer to Chapter Three.



### Multimeter

A multimeter (**Figure 41**) is an essential tool for electrical system diagnosis. The voltage function indicates the voltage applied or available to electrical components. The ohmmeter function tests circuits for continuity, or lack of continuity, and it measures the resistance of a circuit.

Some manufacturers' specifications for electrical components are based on results using a specific test meter. Results may vary if using a meter not rec-

ommended by the manufacturer. Such requirements are noted when applicable.

### Ohmmeter (Analog) Calibration

Each time an analog ohmmeter is used or if the scale is changed, the ohmmeter must be calibrated.

Digital ohmmeters do not require calibration.

1. Make sure the meter battery is in good condition.
2. Make sure the meter probes are in good condition.
3. Touch the two probes together and observe the needle location on the ohms scale. The needle must align with the 0 mark to obtain accurate measurements.
4. If necessary, rotate the meter ohms adjust knob until the needle and 0 mark align.

## ELECTRICAL SYSTEM FUNDAMENTALS

A thorough study of the many types of electrical systems used in today's ATV is beyond the scope of this manual. However, a basic understanding of electrical basics is necessary to perform simple diagnostic tests.

Refer to *Electrical Testing* in Chapter Two for typical test procedures and equipment. Refer to Chapter Nine for specific system test procedures.

### Voltage

Voltage is the electrical potential or pressure in an electrical circuit and is expressed in volts. The more pressure (voltage) in a circuit, the more work can be performed.

Direct current (DC) voltage means the electricity flows in one direction. All circuits powered by a battery are DC circuits.

Alternating current (AC) means the electricity flows in one direction momentarily and then switches to the opposite direction. Alternator output is an example of AC voltage. This voltage must be changed or rectified to direct current to operate in a battery-powered system.

### Resistance

Resistance is the opposition to the flow of electricity within a circuit or component and is mea-

sured in ohms. Resistance causes a reduction in available current and voltage.

Resistance is measured in an inactive circuit with an ohmmeter. The ohmmeter sends a small amount of current into the circuit and measures how difficult it is to push the current through the circuit.

An ohmmeter, although useful, is not always a good indicator of a circuit's actual ability under operating conditions. This is because of the low voltage (6-9 volts) the meter uses to test the circuit. The voltage in an ignition coil secondary winding can be several thousand volts. Such high voltage can cause the coil to malfunction, even though it tests acceptable during a resistance test.

Resistance generally increases with temperature. Perform all testing with the component or circuit at room temperature. Resistance tests performed at high temperatures may indicate high resistance readings and cause unnecessary replacement of a component.

### Amperage

Amperage is the unit of measurement for the amount of current within a circuit. Current is the actual flow of electricity. The higher the current, the more work can be performed up to a given point. If the current flow exceeds the circuit or component capacity, it damages the system.

## BASIC SERVICE METHODS

Most of the procedures in this manual are straightforward and can be performed by anyone reasonably competent with tools. However, consider personal capabilities carefully before performing any operation involving major disassembly.

1. The front of any component is the end closest to the front of the vehicle. The left and right sides refer to the position of the parts as viewed by the rider sitting on the seat facing forward.
2. When servicing an engine or suspension component, secure the vehicle in a safe manner.
3. Tag all similar parts for location and mark all mating parts for position. Record the number and thickness of any shims when removing them. Identify parts by placing them in sealed and labeled plastic sandwich bags.

4. Tag disconnected wires and connectors with masking tape and a marking pen. Do not rely on memory alone.
5. Protect finished surfaces from physical damage or corrosion. Keep gasoline and other chemicals off painted surfaces.
6. Use penetrating oil on frozen or tight bolts. Avoid using heat where possible. Heat can warp, melt or affect the temper of parts. Heat also damages the finish of paint and plastics.
7. When a part is a press fit or requires a special tool to remove, the information or type of tool is identified in the text. Otherwise, if a part is difficult to remove or install, determine the cause before proceeding.
8. To prevent objects or debris from falling into the engine, cover all openings.
9. Read each procedure thoroughly and compare the illustrations to the actual components before starting the procedure. Perform the procedure in sequence.
10. Recommendations are occasionally made to refer service to a dealership or specialist. In these cases, the work can be performed more economically by the specialist than by the home mechanic.
11. The term *replace* means to discard a defective part and replace it with a new part. *Overhaul* means to remove, disassemble, inspect, measure, repair and/or replace parts as required to recondition an assembly.
12. Some operations require using a hydraulic press. If a press is not available, have these operations performed by a shop equipped with the necessary equipment. Do not use makeshift equipment that may damage the vehicle.

#### CAUTION

*Do not direct high-pressure water at steering bearings, fuel hoses, wheel bearings, suspension and electrical components. Water may force grease out of the bearings and possibly damage the seals.*

13. Repairs are much faster and easier if the vehicle is clean before starting work. Degrease the vehicle with a commercial degreaser; follow the directions on the container for the best results. Clean all parts with cleaning solvent when removing them.
14. If special tools are required, have them available before starting the procedure. When special

tools are required, they are described at the beginning of the procedure.

15. Make diagrams of similar-appearing parts. For instance, crankcase bolts are often not the same lengths. Do not rely on memory alone. Carefully laid out parts can become disturbed, making it difficult to reassemble the components correctly.
16. Make sure all shims and washers are reinstalled in the same location and position.
17. Whenever rotating parts contact a stationary part, look for a shim or washer.
18. Use new gaskets if there are any doubts about the condition of old ones.
19. If using self-locking fasteners, replace them. Do not install standard fasteners in place of self-locking ones.
20. Use grease to hold small parts in place if they tend to fall out during assembly. Do not apply grease to electrical or brake components.

#### Removing Frozen Fasteners

If a fastener cannot be removed, several methods may be used to loosen it. First, apply penetrating oil liberally and let it penetrate for 10-15 minutes. Rap the fastener several times with a small hammer. Do not hit it hard enough to cause damage. Reapply the penetrating oil if necessary.

For frozen screws, apply penetrating oil as described, then insert a screwdriver in the slot and rap the top of the screwdriver with a hammer. This loosens the rust so the screw can be removed in the normal way. If the screw head is too damaged to use this method, grip the head with locking pliers and twist the screw out.

Avoid applying heat unless specifically instructed. Heat may melt, warp or remove the temper from parts.

#### Removing Broken Fasteners

If the head breaks off a screw or bolt, several methods are available for removing the remaining portion. If a large portion of the remainder projects out, try gripping it with locking pliers. If the projecting portion is too small, file it to fit a wrench or cut a slot in it to fit a screwdriver (**Figure 42**).

If the head breaks off flush, use a screw extractor. To do this, center punch the exact center of the remaining portion of the screw or bolt (**A, Figure 43**),

and then drill a small hole in the screw (B) and tap the extractor into the hole (C). Back the screw out with a wrench on the extractor (D, **Figure 43**).

### Repairing Damaged Threads

Occasionally, threads are stripped because of carelessness or impact damage. Often the threads can be repaired by running a tap (for internal threads on nuts) or die (for external threads on bolts) through the threads (**Figure 44**). To clean or repair spark plug threads, use a spark plug tap.

If an internal thread is damaged, it may be necessary to install a Helicoil or some other type of thread insert. Follow the manufacturer's instructions when installing their insert.

If it is necessary to drill and tap a hole, refer to **Table 7** for metric tap and drill sizes.

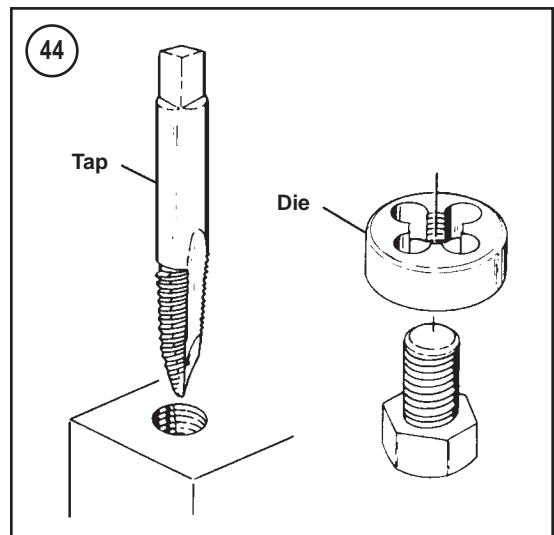
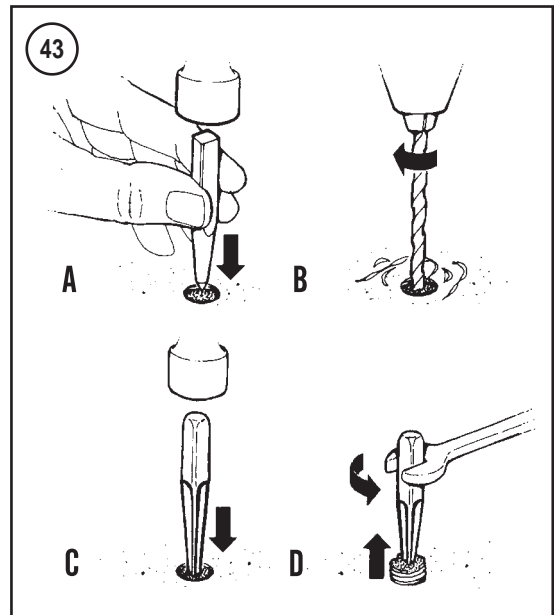
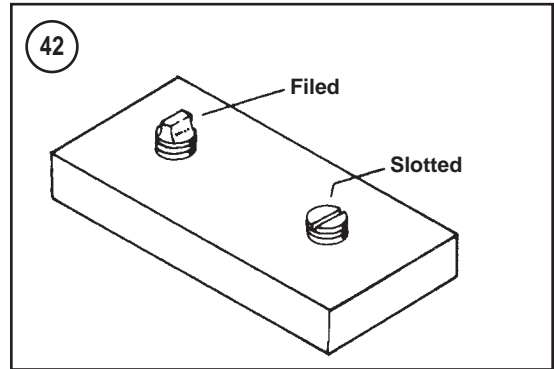
### Stud Removal/Installation

A stud removal tool (**Figure 45**) is available from most tool suppliers. This tool makes the removal and installation of studs easier. If one is not available, thread two nuts onto the stud and tighten them against each other. Remove the stud by turning the lower nut (**Figure 46**).

1. Measure the height of the stud above the surface.
2. Thread the stud removal tool onto the stud and tighten it, or thread two nuts onto the stud.
3. Remove the stud by turning the stud remover or lower nut.
4. Remove any threadlocking compound from the threaded hole. Clean the threads with an aerosol parts cleaner.
5. Install the stud removal tool onto the new stud or thread two nuts onto the stud.
6. Apply threadlocking compound to the threads of the stud.
7. Install the stud and tighten with the stud removal tool or the top nut.
8. Install the stud to the height noted in Step 1 or its torque specification.
9. Remove the stud removal tool or the two nuts.

### Removing Hoses

When removing stubborn hoses, do not exert excessive force on the hose or fitting. Remove the hose clamp and carefully insert a small screwdriver





The lubricant may allow the hose to come off the fitting, even with the clamp secure.

1

## Bearings

### NOTE

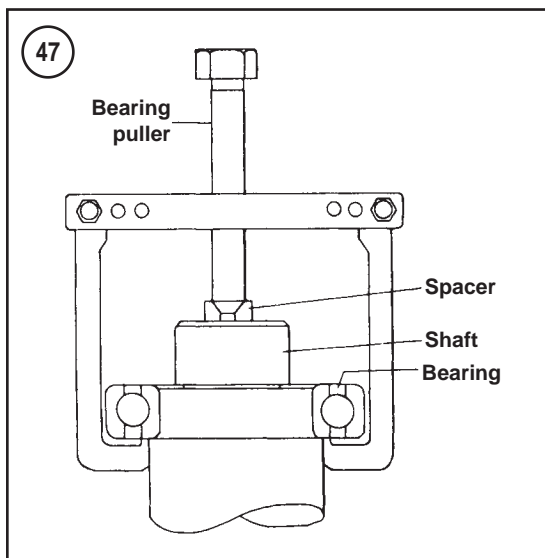
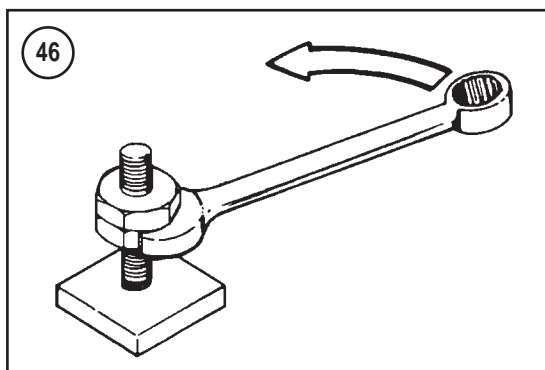
*Unless otherwise specified, install bearings with the manufacturer's mark or number facing outward.*

Bearings are used in the engine and transmission assembly to reduce power loss, heat and noise resulting from friction. Because bearings are precision parts, they must be maintained with proper lubrication and maintenance. If a bearing is damaged, replace it immediately. When installing a new bearing, take care to prevent damaging it. Bearing replacement procedures are included in the individual chapters where applicable; however, use the following sections as a guideline.

## Removal

While bearings are normally removed only when damaged, there may be times when it is necessary to remove a bearing in good condition. However, improper bearing removal damages the bearing and possibly the shaft or case. Note the following when removing bearings:

1. When using a puller to remove a bearing from a shaft, make sure the shaft is not damaged. Always place a piece of metal between the end of the shaft and the puller screw. In addition, place the puller arms next to the inner bearing race. Refer to **Figure 47**.
2. When using a hammer to remove a bearing from a shaft, do not strike the hammer directly against the shaft. Instead, use a brass or aluminum rod between the hammer and shaft (**Figure 48**) and make sure to support both bearing races with wooden blocks as shown.
3. The ideal method of bearing removal is with a hydraulic press. Note the following:
  - a. Always support the inner and outer bearing races with a suitable size wooden or aluminum spacer (**Figure 49**). If only the outer race is supported, pressure applied against the balls and/or the inner race damages them.
  - b. Always make sure the press arm (**Figure 49**) aligns with the center of the shaft. If the arm is not centered, it may damage the bearing and/or shaft.



or pick tool between the fitting and hose. Apply a spray lubricant under the hose and carefully twist the hose off the fitting. Clean the fitting of any corrosion or rubber hose material with a wire brush. Clean the inside of the hose thoroughly. Do not use any lubricant when installing the hose (new or old).

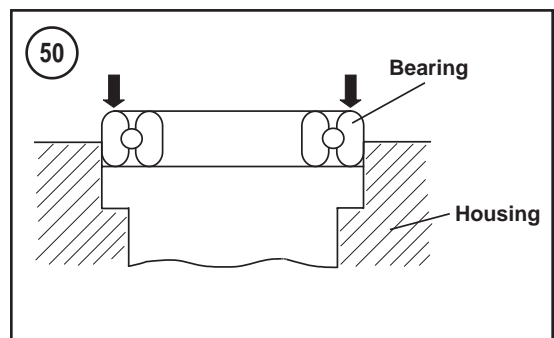
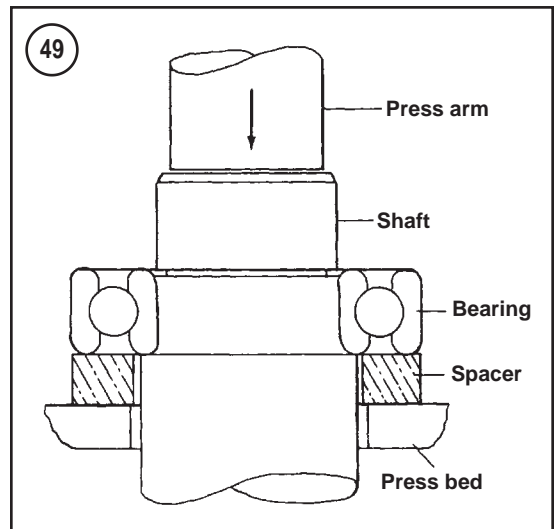
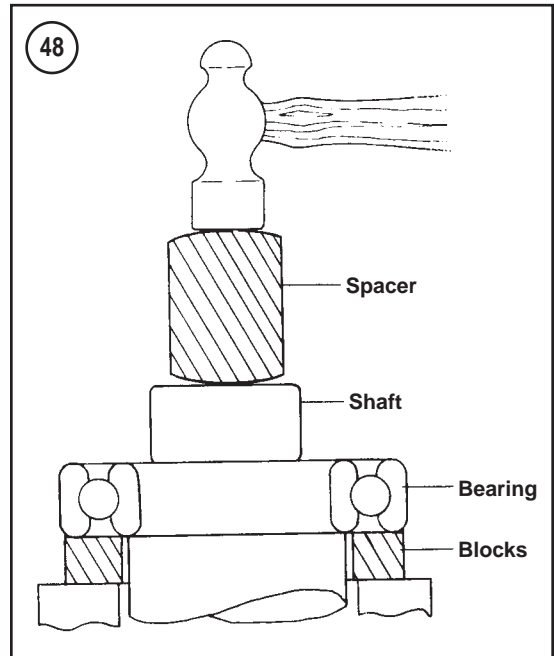
- c. The moment the shaft is free of the bearing, it drops to the floor. Secure or hold the shaft to prevent it from falling.

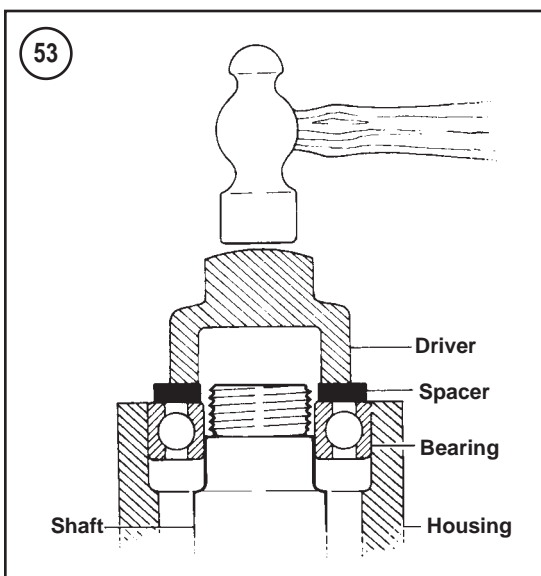
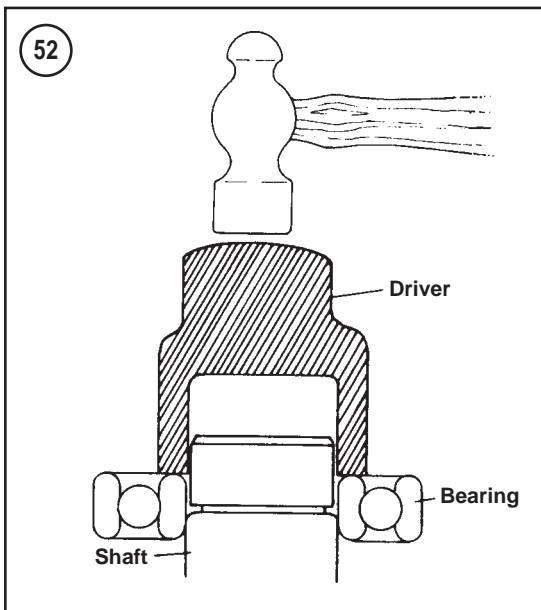
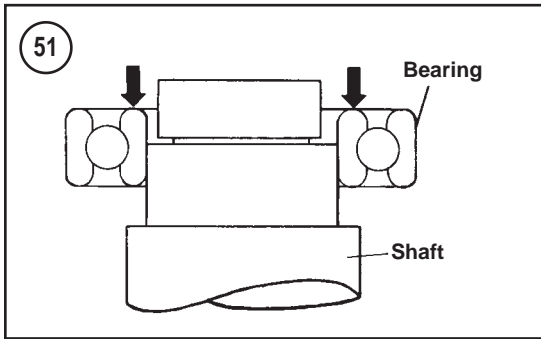
### Installation

1. When installing a bearing in a housing, apply pressure to the *outer* bearing race (**Figure 50**). When installing a bearing on a shaft, apply pressure to the *inner* bearing race (**Figure 51**).
2. When installing a bearing as described in Step 1, a driver is required. Never strike the bearing directly with a hammer or it damages the bearing. When installing a bearing, use a piece of pipe or a driver with a diameter that matches the bearing inner race. **Figure 52** shows the correct way to use a driver and hammer to install a bearing.
3. Step 1 describes how to install a bearing in a case half or over a shaft. However, when installing a bearing over a shaft and into the housing at the same time, a tight fit is required for both outer and inner bearing races. In this situation, install a spacer underneath the driver tool so pressure is applied evenly across both races. Refer to **Figure 53**. If the outer race is not supported as shown, the balls push against the outer bearing race and damage it.

### Interference fit

1. Follow this procedure when installing a bearing over a shaft. When a tight fit is required, the bearing inside diameter is smaller than the shaft. In this case, driving the bearing on the shaft using normal methods may cause bearing damage. Instead, heat the bearing before installation. Note the following:
  - a. Secure the shaft so it is ready for bearing installation.
  - b. Clean all residues from the bearing surface of the shaft. Remove burrs with a file or sandpaper.
  - c. Fill a suitable pot or beaker with clean mineral oil. Place a thermometer rated above 120° C (248° F) in the oil. Support the thermometer so it does not rest on the bottom or side of the pot.
  - d. Remove the bearing from its wrapper and secure it with a piece of heavy wire bent to hold it in the pot. Hang the bearing in the pot so it does not touch the bottom or sides of the pot.





- e. Turn the heat on and monitor the thermometer. When the oil temperature rises to approximately 120° C (248° F), remove the bearing from the pot and quickly install it. If necessary, place a socket on the inner bearing race and tap the bearing into place. As the bearing chills, it tightens on the shaft, so installation must be done quickly. Make sure the bearing is installed completely.

**CAUTION**

*Before heating the housing in this procedure, wash the housing thoroughly with detergent and water. Rinse and rewash the cases as required to remove all traces of oil and other chemical deposits.*

2. Follow this step when installing a bearing in a housing. Bearings are generally installed in a housing with a slight interference fit. Driving the bearing into the housing using normal methods may damage the housing or cause bearing damage. Instead, heat the housing before the bearing is installed. Note the following:

**CAUTION**

*Do not heat the housing with a propane or acetylene torch. Never bring a flame into contact with the bearing or housing. The direct heat destroys the case hardening of the bearing and likely warps the housing.*

- a. Heat the housing to approximately 100° C (212° F) in an oven or on a hot plate. An easy way to check that it is the proper temperature is to place tiny drops of water on the housing; if they sizzle and evaporate immediately, the temperature is correct. Heat only one housing at a time.
- b. Remove the housing from the oven or hot plate, and hold onto the housing with welding gloves. It is hot!
- c. Hold the housing with the bearing side down and tap the bearing out. Remove and install the bearings with a suitable size socket and extension. Repeat for all bearings in the housing.
- d. Before heating the bearing housing, place the new bearing in a freezer if possible. Chilling a bearing slightly reduces its outside diameter while the heated bearing housing assembly is

slightly larger due to heat expansion. This makes bearing installation easier.

- e. While the housing is still hot, install the new bearing(s) into the housing. Unless noted otherwise, install bearings with the manufacturer's mark or number facing out. Install the bearings by hand, if possible. If necessary, lightly tap the bearing(s) into the housing with a driver placed on the outer bearing race (**Figure 50**). Do not install new bearings by driving on the inner-bearing race. Install the bearing(s) until it seats completely.

### Seal Replacement

Seals (**Figure 54**) contain oil, water, grease or combustion gasses in a housing or shaft. Improperly removing a seal can damage the housing or shaft. Improperly installing the seal can damage the seal. Note the following:

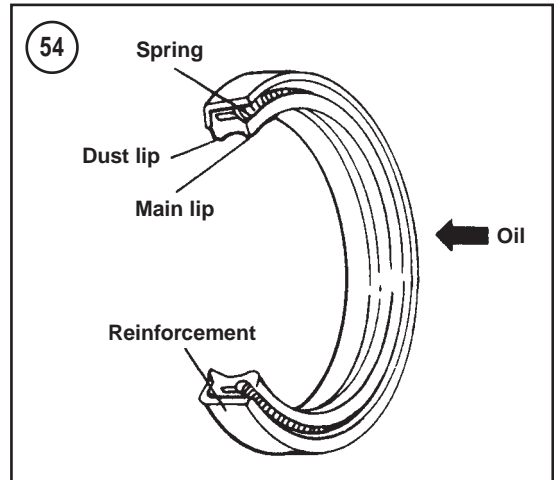
1. Prying is generally the easiest and most effective method of removing a seal from the housing. However, always place a rag underneath the pry tool (**Figure 55**) to prevent damage to the housing. Note the seal's installed depth or if it is installed flush.
2. Pack waterproof grease in the seal lips before the seal is installed.
3. In most cases, install seals with the manufacturer's numbers or marks facing out.
4. Install seals with a socket or driver placed on the outside of the seal as shown in **Figure 56**. Drive the seal squarely into the housing until it is to the correct depth or flush as noted during removal. Never install a seal by hitting against the top of it with a hammer.

### STORAGE

Several months of non-use can cause a general deterioration of the vehicle. This is especially true in areas of extreme temperature variations. This deterioration can be minimized with careful preparation for storage. A properly stored ATV is much easier to return to service.

#### Storage Area Selection

When selecting a storage area, consider the following:

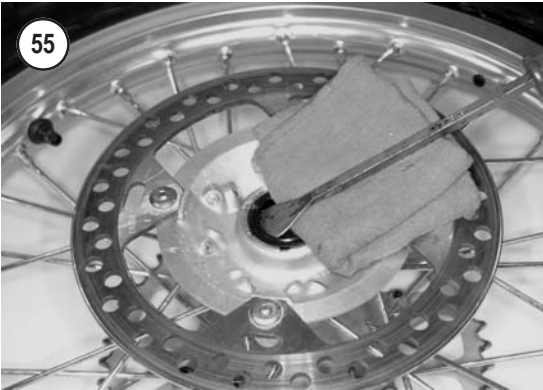


1. The storage area must be dry. A heated area is best, but not necessary. It should be insulated to minimize extreme temperature variations.
2. If the building has large window areas, mask them to keep sunlight off the vehicle.
3. Avoid buildings in industrial areas where corrosive emissions may be present. Avoid areas close to saltwater.
4. Consider the area's risk of fire, theft or vandalism. Check with an insurer regarding ATV coverage while in storage.

#### Preparing the Vehicle for Storage

The amount of preparation a vehicle should undergo before storage depends on the expected length of non-use, storage area conditions and personal preference. Consider the following list the minimum requirement:

1. Wash the vehicle thoroughly. Make sure all dirt, mud and road debris are removed.
2. Fill the fuel tank with a mixture of fuel and fuel stabilizer. Mix the fuel and stabilizer in the ratio recommended by the stabilizer manufacturer. Run the engine for a few minutes so the stabilized fuel can enter the fuel system. If storing the ATV for a long period, consider draining the fuel system.
3. Start the engine and allow it to reach operating temperature. Drain the engine oil regardless of the riding time since the last service. Fill the engine with the recommended type of oil.
4. Remove the spark plug and pour a teaspoon (15-20 ml) of engine oil into the cylinder. Place a



- rag over the openings and slowly turn the engine over to distribute the oil. Reinstall the spark plug.
5. Remove the battery. Store the battery in a cool and dry location. Charge the battery once a month.
6. Cover the exhaust and intake openings.
7. Apply a protective substance to the plastic and rubber components. Make sure to follow the manufacturer's instructions for each type of product being used.
8. Rotate the tires periodically to prevent flat spots from developing and damaging them.
9. Cover the vehicle with old bed sheets or something similar. Do not cover it with any plastic material that traps moisture.

Returning the Vehicle to Service

The amount of service required when returning a vehicle to service after storage depends on the length of non-use and storage conditions. In addition to performing the reverse of the above procedure, make sure the brakes, clutch, throttle and engine stop switch work properly before operating the vehicle. Refer to Chapter Three and evaluate the service intervals to determine which areas require service.

Table 1 VEHICLE IDENTIFICATION NUMBER (VIN)<sup>1,2</sup>

Characters 1-3 XXX	Characters 4-8 XXXXX	Character 9 X	Character 10 X	Character 11 X	Characters 12-17 XXXXXX
<p>Characters 1-3: World Manufacturing Identifier (WMI). These characters represent the manufacturer and the type of vehicle.</p> <p>Characters 4-8: Vehicle attributes. These characters represent make, model and engine type.</p> <p>Character 9: Check digit. This digit verifies the accuracy of the VIN transcription. The digit is mathematically determined using values assigned to the other characters in the VIN.</p> <p>Character 10: Model year. The year is assigned to the model by the manufacturer and does not represent the year of manufacture. The letters I, O, Q, U, Z and the numeral 0 are not used in the model year code.</p> <p>The letter X= 1999, Y=2000.</p> <p>The number 1= 2001, 2= 2002, and so on until 2010.</p> <p>The letter A= 2010, B=2011, and so on.</p> <p>Character 11: Manufacturing plant location.</p> <p>Characters 12-17: Sequential production number, as assigned by the manufacturer.</p>					
<p>1. The VIN consists of 17 characters, with character groups representing the manufacturer and unique information about the motorcycle model.</p> <p>2. VIN standards are periodically revised by the National Highway Traffic Safety Administration (NHTSA). Refer to their documentation for additional information.</p>					

**Table 2 VEHICLE DIMENSIONS**

Overall length	1735 mm (63.3 in.)
Overall width	1061 mm (41.8 in.)
Overall height	1073 mm (42.2 in.)
Wheelbase	1124 mm (44.3 in.)
Track	
Front	807 mm (31.8 in.)
Rear	805 mm (31.7 in.)
Ground clearance	149 mm (5.9 in.)
Seat height	794 mm (31.3 in.)
Footpeg height	319 mm (12.6 in.)

**Table 3 VEHICLE WEIGHT**

Dry weight	158 kg (349 lbs.)
Curb weight	166 kg (367 lbs.)
Maximum weight capacity	110 kg (243 lbs.)

**Table 4 CONVERSION FORMULAS**

<b>Multiply:</b>	<b>By:</b>	<b>To get the equivalent of:</b>
Length		
Inches	25.4	Millimeter
Inches	2.54	Centimeter
Miles	1.609	Kilometer
Feet	0.3048	Meter
Millimeter	0.03937	Inches
Centimeter	0.3937	Inches
Kilometer	0.6214	Mile
Meter	0.0006214	Mile
Fluid volume		
U.S. quarts	0.9463	Liters
U.S. gallons	3.785	Liters
U.S. ounces	29.573529	Milliliters
Imperial gallons	4.54609	Liters
Imperial quarts	1.1365	Liters
Liters	0.2641721	U.S. gallons
Liters	1.0566882	U.S. quarts
Liters	33.814023	U.S. ounces
Liters	0.22	Imperial gallons
Liters	0.8799	Imperial quarts
Milliliters	0.033814	U.S. ounces
Milliliters	1.0	Cubic centimeters
Milliliters	0.001	Liters
Torque		
Foot-pounds	1.3558	Newton-meters
Foot-pounds	0.138255	Meters-kilograms
Inch-pounds	0.11299	Newton-meters
Newton-meters	0.7375622	Foot-pounds
Newton-meters	8.8507	Inch-pounds
Meters-kilograms	7.2330139	Foot-pounds

(continued)

**Table 4 CONVERSION FORMULAS (continued)**

<b>Multiply:</b>	<b>By:</b>	<b>To get the equivalent of:</b>
Volume		
Cubic inches	16.387064	Cubic centimeters
Cubic centimeters	0.0610237	Cubic inches
Temperature		
Fahrenheit	$(^{\circ}\text{F} - 32) \times 0.556$	Centigrade
Centigrade	$(^{\circ}\text{C} \times 1.8) + 32$	Fahrenheit
Weight		
Ounces	28.3495	Grams
Pounds	0.4535924	Kilograms
Grams	0.035274	Ounces
Kilograms	2.2046224	Pounds
Pressure		
Pounds per square inch	0.070307	Kilograms per square centimeter
Kilograms per square centimeter	14.223343	Pounds per square inch
Kilopascals	0.1450	Pounds per square inch
Pounds per square inch	6.895	Kilopascals
Speed		
Miles per hour	1.609344	Kilometers per hour
Kilometers per hour	0.6213712	Miles per hour

**Table 5 TECHNICAL ABBREVIATIONS**

ABDC	After bottom dead center
ATDC	After top dead center
BBDC	Before bottom dead center
BDC	Bottom dead center
BTDC	Before top dead center
C	Celsius
cc	Cubic centimeter
CDI	Capacitor discharge ignition
cu. in.	Cubic inch and cubic inches
F	Fahrenheit
ft.-lb.	Foot pounds
gal.	Gallon and gallons
H/A	High altitude
hp	Horsepower
in.	Inch and inches
kg	Kilogram
kg/cm <sup>2</sup>	Kilogram per square centimeter
kgm	Kilogram meter
km	Kilometer
L	Liter and liters
m	Meter
MAG	Magneto
mL	Milliliter
mm	Millimeter
N•m	Newton meter
oz.	Ounce and ounces
psi	Pounds per square inch
PTO	Power take off
pt.	Pint and pints
qt.	Quart and quarts
rpm	Revolution per minute

**Table 6 METRIC, INCH AND FRACTIONAL EQUIVALENTS**

mm	in.	Nearest fraction	mm	in.	Nearest fraction
1	0.0394	1/32	26	1.0236	1 1/32
2	0.0787	3/32	27	1.0630	1 1/16
3	0.1181	1/8	28	1.1024	1 3/32
4	0.1575	5/32	29	1.1417	1 5/32
5	0.1969	3/16	30	1.1811	1 3/16
6	0.2362	1/4	31	1.2205	1 7/32
7	0.2756	9/32	32	1.2598	1 1/4
8	0.3150	5/16	33	1.2992	1 5/16
9	0.3543	11/32	34	1.3386	1 11/32
10	0.3937	13/32	35	1.3780	1 3/8
11	0.4331	7/16	36	1.4173	1 13/32
12	0.4724	15/32	37	1.4567	1 15/32
13	0.5118	1/2	38	1.4961	1 1/2
14	0.5512	9/16	39	1.5354	1 17/32
15	0.5906	19/32	40	1.5748	1 9/16
16	0.6299	5/8	41	1.6142	1 5/8
17	0.6693	21/32	42	1.6535	1 21/32
18	0.7087	23/32	43	1.6929	1 11/16
19	0.7480	3/4	44	1.7323	1 23/32
20	0.7874	25/32	45	1.7717	1 25/32
21	0.8268	13/16	46	1.8110	1 13/16
22	0.8661	7/8	47	1.8504	1 27/32
23	0.9055	29/32	48	1.8898	1 7/8
24	0.9449	15/16	49	1.9291	1 15/16
25	0.9843	31/32	50	1.9685	1 31/32

**Table 7 METRIC TAP DRILL SIZE**

Metric size	Drill equivalent	Decimal fraction	Nearest fraction
3 × 0.50	No. 39	0.0995	3/32
3 × 0.60	3/32	0.0937	3/32
4 × 0.70	No. 30	0.1285	1/8
4 × 0.75	1/8	0.125	1/8
5 × 0.80	No. 19	0.166	11/64
5 × 0.90	No. 20	0.161	5/32
6 × 1.00	No. 9	0.196	13/64
7 × 1.00	16/64	0.234	15/64
8 × 1.00	J	0.277	9/32
8 × 1.25	17/64	0.265	17/64
9 × 1.00	5/16	0.3125	5/16
9 × 1.25	5/16	0.3125	5/16
10 × 1.25	11/32	0.3437	11/32
10 × 1.50	R	0.339	11/32
11 × 1.50	3/8	0.375	3/8
12 × 1.50	13/32	0.406	13/32
12 × 1.75	13/32	0.406	13/32

Table 8 GENERAL TORQUE SPECIFICATIONS

Fastener size or type	N•m	In.-lb.	ft.-lb.
5 mm screw	4	35	—
5 mm bolt and nut	5	44	—
6 mm screw	9	80	—
6 mm bolt and nut	10	88	—
6 mm flange bolt (8 mm head, small flange)	9	80	—
6 mm flange bolt (10 mm head) and nut	12	106	—
8 mm bolt and nut	22	—	16
8 mm flange bolt and nut	27	—	20
10 mm bolt and nut	35	—	26
10 mm flange bolt and nut	40	—	30
12 mm bolt and nut	55	—	41

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